Notes on the genus *Neodiphthera* Fletcher, 1982 with description of three new species (Lepidoptera, Saturniidae)

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Abstract: Notes on the Indo-Australian genus *Neodiphthera* Fletcher, 1982 are given. Within the genus, here is only dealt with a group of species related to *N. papuana* (Rothschild, 1904) and *N. albicera* (Rothschild & Jordan, 1907), both from mountainous regions of Papua New Guinea and West Papua (Indonesia), which occurs solely in the lowlands and along the coastlines of the Arafura Sea. Three species are described as new: *N. **territorialis*** **sp. n.** from Northern Territory, Australia (holotype female in Northern Territory Museum, Darwin, Australia); *N. **sophiae*** **sp. n.** from Kai Island, Indonesia, and *N. **campestris*** **sp. n.** from the southern lowlands of West Papua, Indonesia (both holotype males in Museum für Naturkunde, Berlin, Germany). They are compared with their nearest relatives, *N. sulphurea* Lane & Naumann, 2003 from northeastern Queensland, Australia, and *N. sahulensis* (U. Paukstadt et al., 2003) from Aru Archipelago, Indonesia. All involved taxa and their male genitalia structures are figured.

Key words: *Neodiphthera*, new species, Australia, Northern Territory, Indonesia, Moluccas, West Papua, Arafura Sea.

Bemerkungen zur Gattung *Neodiphthera* Fletcher, 1982 mit Beschreibung drei neuer Arten (Lepidoptera, Saturniidae)

Zusammenfassung: Bemerkungen zur Gattung *Neodiphthera* Fletcher, 1982 werden publiziert. Innerhalb der Gattung wird nur eine Gruppe von Arten aus der Verwandtschaft von *N. papuana* (Rothschild, 1904) und *N. albicera* (Rothschild & Jordan, 1907), beide aus den bergigen Regionen von Neuguinea, behandelt, die in ihrer Verbreitung beschränkt ist auf das Flachland und die Küstenlinien entlang der Arafurasee. Drei Arten werden als neu beschrieben: *N. **territorialis*** **sp. n.** aus dem Northern Territory, Australien (Holotypus Weibchen im Northern Territory Museum, Darwin, Australien); *N. **sophiae*** **sp. n.** von der indonesischen Insel Kei und *N. **campestris*** **sp. n.** aus dem südlichen Flachland der indonesischen Provinz West-Papua (beide männlichen Holotypen im Museum für Naturkunde, Berlin, Deutschland). Sie werden mit ihren nächsten Verwandten, *N. sulphurea* Lane & Naumann, 2003 aus dem nordöstlichen Teil von Queensland, Australien, sowie *N. sahulensis* (U. Paukstadt et al., 2003) vom Aru-Archipel in Indonesien verglichen. Die genannten Taxa sowie ihre männlichen Genitalstrukturen werden abgebildet.

Introduction

At the time of describing *N. sulphurea* in 2003 from northeastern Queensland, the authors then drew attention to an outlying female *Neodiphthera* specimen recorded from Groote Eylandt in the Northern Territory, held in the Australian National Insect Collection in Canberra, and excluded that specimen deliberately from the *N. sulphurea* type series. The basis of exclusion at that time was elements of its general appearance and its location of collecting, as no other *Neodiphthera* specimens were then known from the Northern Territory. The collector of that specimen, the late John d'Apice, later confirmed the authenticity of the locality data, and the specimen was provisionally referred to *N. sulphurea* (Lane 2004).

During the last few years a further number of similar *Neodiphthera* specimens have been collected from various locations across the top end of the Northern Territory, Australia, enabling a closer comparison with material from Queensland, Papua New Guinea and Indonesia. Its distinctive facies and general morphology, combined with recent studies made available within the Canadian BOLD project (Barcode of Life 2013) immediately give clear separation to all other known species.

Within that project and the results therein it became clear that the genus *Neodiphthera* contains a species group where all members occur only in the lowlands of the coastlines and involved islands around the so-called Arafura Sea — an area contained by the northern coastline of Australia, some Moluccan islands in the west, and the southern coastline of New Guinea (see map, Fig. 1). This cluster is herein treated and is shown in the 'Minimum Evolution' (ME) tree (Fig. 2). It consists of a group of five different taxa which obviously are all closely related (thereby only a small percentage of COI-DNA differences can be found), but differ widely geographically and have been well separated at least since the last glacial period. For details of the specimens analysed, see Table 1.

We do not deal here with those many species described already; a most recent overview was given by Paukstadt & Paukstadt (2012a & b). Our concern is to provide recognition of the species group mentioned above for which so far two representatives are known:

- *N. sulphurea* from Iron Range and Silver Plains in central Cape York Peninsula of Queensland, Australia. This species apperently is absent from the Bamaga area on northern Cape York Peninsula where suitable habitats exist, and from areas in north western Queensland, to the border of Northern Territory.
- *N. sahulensis* was described from the Moluccan Aru Archipelago, Indonesia, and is known there from the islands of Wokam and Kobroor so far (Paukstadt & Paukstadt 2012a: 246; records in CBH, CSLL, CSNB). Paukstadt & Paukstadt (2003: 66) mention this taxon also for the Kai Archipelago, but recent analyses and studies gave hints to interprete this as a different species.

In the following we describe three species in this group as new. A study of the mtDNA sequencing variances of members of this species group give clear separation of

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N. sulphurea from all others. Analysis of separation of *N. sahulensis* from the three new taxa described here is less obvious. However, when looking at the extreme divergence of biogeographic regions from which they occur (at least the Kai Archipelago was never connected with the Aru Archipelago or the southern coast of New Guinea during past glacial periods) and in combination with relatively large morphological differences for the genus *Neodiphthera* we decided to handle these taxa on full species rank.

Abbreviations used

Collections

ANIC Australian National Insect Collection, Canberra, ACT, Australia.
CBH Collection Brosch, Hille, Germany.
CDLA Collection of David Lane, Atherton, Qld., Australia.
CLPW Collection of Laela Hayati Paukstadt, Wilhelmshaven, Germany.
CSLL Collection Swen Löffler, Lichtenstein/Sachsen, Germany.
CSNB Collection of Stefan Naumann, Berlin, Germany.
NTM Northern Territory Museum, Darwin, NT, Australia.
ZMHU Museum für Naturkunde, Berlin, Germany (formerly: Zoologisches Museum der Humboldt-Universität, Berlin).

Other abbreviations

BC Barcode [no.].
GP Genitalia dissection/preparation [no.].
HT Holotype.
PT Paratype.

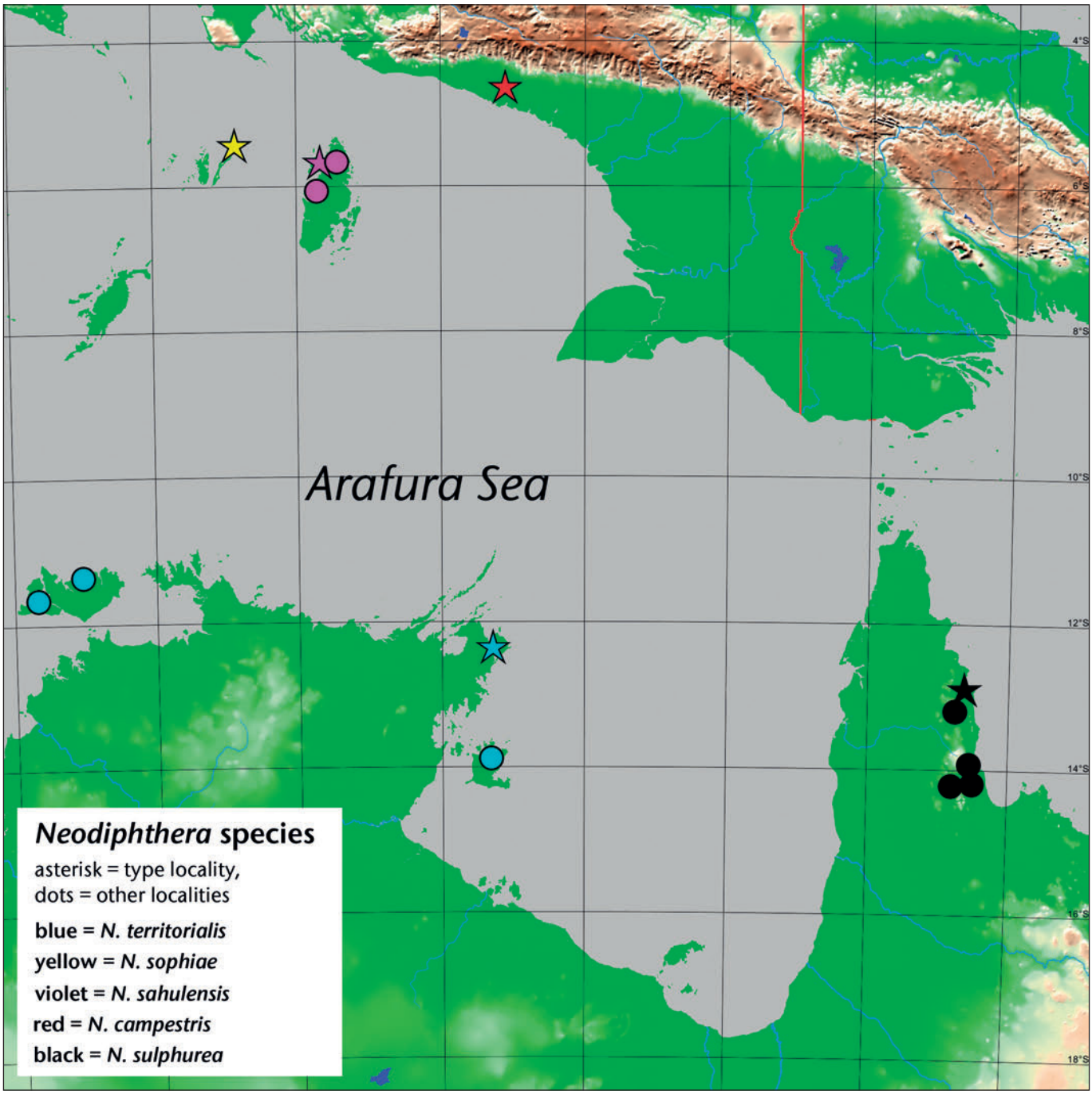

Fig. 1 (map): Distribution of the species of *Neodiphthera* occurring in the lowlands around the Arafura Sea. One symbol may represent more than one locality in close proximity. Colour code legend see in map. — Map created with Map Creator 2.0 Personal Edition, © 2003–2007 primap software, modified and localities added.

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Table 1: Data of the specimens of *Neodiphthera* of the *sahulensis/sulphurea* group of species dealt with here, used for the mtDNA sequence analyses. — Additional abbreviations: GBAC = GenBank Access Code; HT = holotype; PT = paratype; SL = Sequence Length (data from BOLD); — = GBAC not yet available.

Species	Sample-ID	Process-ID	GBAC	SL	Sex	Deposition	Locality of origin
Neodiphthera sulphurea, paratype	SNB 471	SASNA471-08	–	658[0n]bp	♂	CSNB	Australia, Queensland
Neodiphthera sulphurea	SNB 472	SASNA472-08	–	658[0n]bp	♂	CSNB	Australia, Queensland
Neodiphthera territorialis n. sp., paratype	SNB 2010	SASNB915-10	HQ973604	658[0n]bp	♂	CDLA	Australia, Northern Territory
Neodiphthera territorialis n. sp., paratype	SNB 2086	SASNC002-11	JN278638	658[0n]bp	♀	CSNB	Australia, Northern Territory
Neodiphthera sahulensis, paratype	ULP 0047	SAUPA047-09	HM383738	658[0n]bp	♂	CLPW	Indonesia, Aru
Neodiphthera sahulensis	SNB 1591	SASNB591-09	HM383519	658[0n]bp	♂	CSLL	Indonesia, Aru
Neodiphthera sahulensis	SNB 1882	SASNB787-10	–	658[0n]bp	♂	CBH	Indonesia, Aru
Neodiphthera sahulensis	SNB 4964	SASNC2500-13	–	658[0n]bp	♂	CSNB	Indonesia, Aru
Neodiphthera sophiae n. sp., holotype	SNB 1883	SASNB788-10	HQ579821	658[0n]bp	♂	CBH > ZMHU	Indonesia, Kai
Neodiphthera campestris n. sp., paratype	SNB 468	SASNA468-08	–	590[0n]bp	♂	CSNB	Indonesia, West Papua
Neodiphthera campestris n. sp., holotype	SNB 1814	SASNB719-10	HQ579780	658[0n]bp	♂	CSNB > ZMHU	Indonesia, West Papua

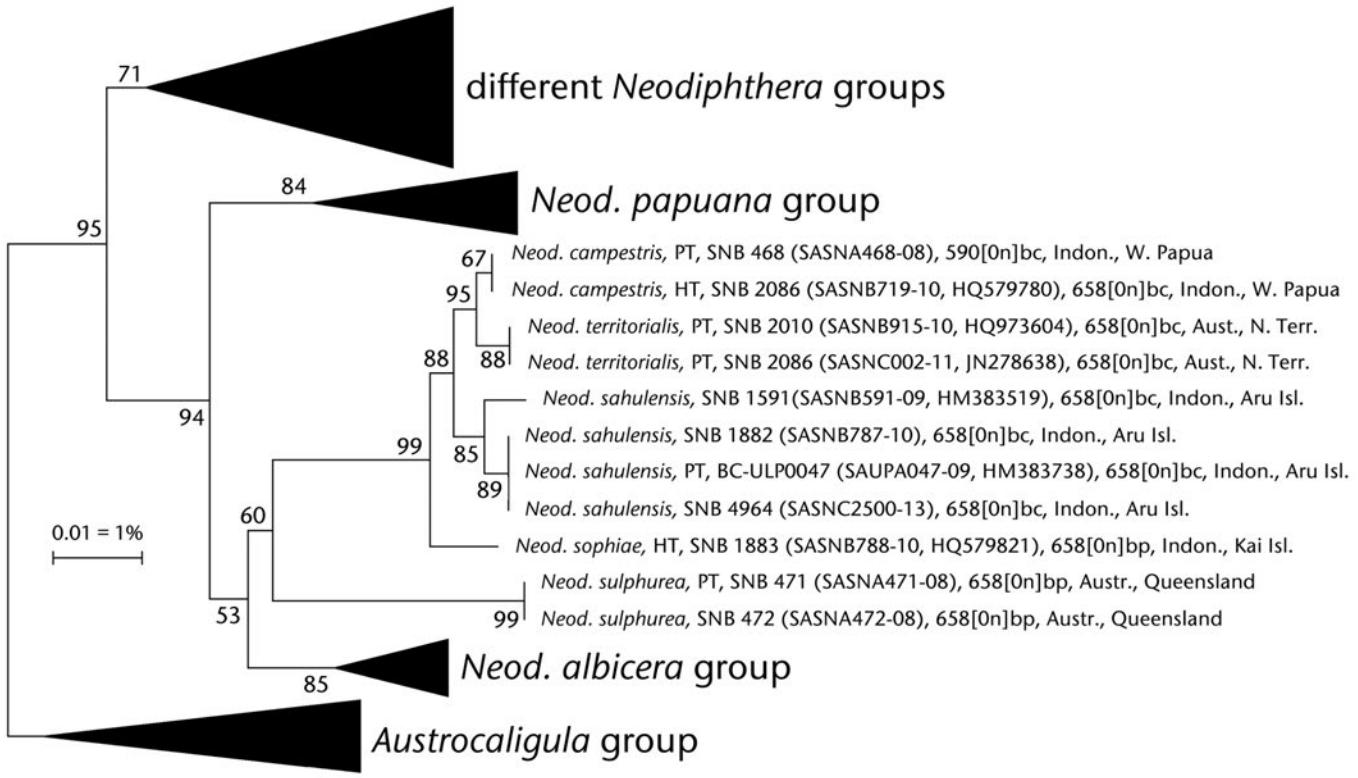
different Neodiphthera groups
Neod. papuana group
Neod. albicera group
Austrocaligula group
Neod. campestris, PT, SNB 468 (SASNA468-08), 590[0n]bc, Indon., W. Papua
Neod. campestris, HT, SNB 2086 (SASNB719-10, HQ579780), 658[0n]bc, Indon., W. Papua
Neod. territorialis, PT, SNB 2010 (SASNB915-10, HQ973604), 658[0n]bc, Aust., N. Terr.
Neod. territorialis, PT, SNB 2086 (SASNC002-11, JN278638), 658[0n]bc, Aust., N. Terr.
Neod. sahulensis, SNB 1591(SASNB591-09, HM383519), 658[0n]bc, Indon., Aru Isl.
Neod. sahulensis, SNB 1882 (SASNB787-10), 658[0n]bc, Indon., Aru Isl.
Neod. sahulensis, PT, BC-ULP0047 (SAUPA047-09, HM383738), 658[0n]bc, Indon., Aru Isl.
Neod. sahulensis, SNB 4964 (SASNC2500-13), 658[0n]bc, Indon., Aru Isl.
Neod. sophiae, HT, SNB 1883 (SASNB788-10, HQ579821), 658[0n]bp, Indon., Kai Isl.
Neod. sulphurea, PT, SNB 471 (SASNA471-08), 658[0n]bp, Austr., Queensland
Neod. sulphurea, SNB 472 (SASNA472-08), 658[0n]bp, Austr., Queensland
0.01 = 1%
71
84
95
67
95
88
88
99
85
89
60
94
53
99
85

Fig. 2: Evolutionary relationships of taxa. The evolutionary history was inferred using the Minimum Evolution (ME) method (RZHETSKY & NEI 1992). The bootstrap consensus tree inferred from 1000 replicates is taken to represent the evolutionary history of the taxa analyzed (FELSENSTEIN 1985). The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test are shown next to the branches. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. The evolutionary distances were computed using the Maximum Composite Likelihood method (TAMURA et al. 2004) and are in the units of the number of base substitutions per site. The rate variation among sites was modelled with a gamma distribution (shape parameter = 3). The differences in the composition bias among sequences were considered in evolutionary comparisons (TAMURA & KUMAR 2002). The ME tree was searched using the Close-Neighbor-Interchange (CNI) algorithm (NEI & KUMAR 2000) at a search level of 0. The Neighbor-joining algorithm (SAITOU & NEI 1987) was used to generate the initial tree. The analysis involved 128 nucleotide sequences = individual specimens, 11 of which are shown here (the others do not belong to the *sahulensis/sulphurea* group of species dealt with here). Codon positions included were 1st+2nd+3rd+Noncoding. All positions with less than 95% site coverage were eliminated. That is, fewer than 5% alignment gaps, missing data, and ambiguous bases were allowed at any position, resulting in a total of 552 positions (= nucleotid base pairs) in the final dataset. Evolutionary analyses were conducted in MEGA5 (TAMURA et al. 2011). Species groups of the genus *Neodiphthera* and related genera not dealt with in the present publication are compressed here. For details of the specimens used for this graph, see Table 1.

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Systematic part

Neodiphthera territorialis sp. n.

Holotype ♀ (Fig. 3): Australia, Northern Territory, 0633818, 8807556, UTM53, Gurrumuru, 19. VI. 2007, leg. M. F. Braby; NT Museum 15242, *Neodiphthera sulphurea*, det. M. F. Braby (NTM). A red holotype label will be added accordingly.

Paratypes (in total 1 ♂, 6 ♀♀, all from Australia, Northern Territory; Figs. 4–6): 1 ♀, Groote Eylandt, 18. V. 1982, J. W. C. d'Apice & V. J. Robinson (ANIC). 1 ♀, Melville Island, Snake Bay, Milikapiti, 11°25.261′ S, 130°39.688′ E, 21. III. 2009, leg. D. A. Lane (CDLA). 1 ♂, 1 ♀, Melville Island, Snake Bay, Milikapiti, 14. III. 2010, leg. D. A. Lane, ♂-GP 2239/11 SNB, BC SNB 2010 (♂) (CDLA). 1 ♀, Melville Island, Snake Bay, 16. III. 2010, leg. D. A. Lane, BC SNB 2086 (CSNB). 1 ♀, Bathurst Island, Wurankuwu, 11° 37.085′ S, 130°16.588′ E, 3. III. 2009, MV light trap, leg. D. A. Young (CDLA). 1 ♀, Tiwi Islands, Bathurst Island, Wurankuwu, 11°37.085′ S, 130°16.588′ E, 3. III. 2009 at MV light, leg. D. A. Young, NTM I.6204 (NTM). Blue paratype labels will be added accordingly.

Etymology. Named as a distinctive species currently known only from the Northern Territory, Australia.

Description.

Male (Fig. 6). Forewing length (from wing basis to apex) 38 mm. Eyes black. Antennae 7.5 mm long, 23–24 segments, broadly quadripectinate except last 4–5 segments, longest rami 1.2 mm long. The only known ♂ specimen to date is a yellow colour morph.

Dorsal ground colour pale lemon yellow. Upper thorax with a reddish brown band behind head, extending onto forewing costa. Forewing with costa straight for basal two thirds, then evenly but broadly bowed to apex; apex acutely rounded, termen straight, hindmargin straight and tornus rounded. Hindwing with termen unevenly rounded, tornus bowed, dorsum straight.

Forewing upperside with costa broadly edged reddish brown on basal half, extending lightly to apex. An oblique reddish brown band extends from apex to one quarter inner margin, almost straight. A series of reddish brown outer spots runs roughly parallel from near apex to near tornus. A similar coloured inner but indented band extends from less than one half costa to less than half inner margin, indented below cell. Eyespot at end of cell infilled reddish brown, ringed darker reddish brown. A broad reddish brown patch straddles both sides of oblique band at apex. Termen lightly fringed reddish brown.

Hindwing with reddish brown wavy line extending from near apex to lower dorsum, roughly parallel to wing margin. Inner submedian reddish brown line runs from dorsum to top of discall cell; an outer series of reddish brown spots, fairly diffuse, runs adjacent and parallel to submedian line. Eyespot at end of cell distinct, strongly ringed reddish brown, with central reddish brown spot, infill between central spot and outer ring lemon yellow. Termen lightly fringed reddish brown.

Ventral side of both fore- and hindwing similar to upperside, with line marking slightly more intense. Hindwing eyespot with outer half ring strongly reddish brown, basal half ring strongly reddish, with an inner inset half crescent reddish band roughly parallel. An inner reddish brown central spot, infill between central spot and outer ring lemon yellow.

Male genitalia (Fig. 13). Generally, genitalia structures within the genus look very similar overall but differ constantly (where known from series) in size and form of different parts and the combination of those. *N. territorialis* n. sp. (only one ♂ known) has a relatively long slender uncus with almost fused tip, with only two small dorsolateral protuberances, and thereby differs from all other members of the genus. Valves with a small and very little sclerotized distal tip. The internal processes of the valves (= labides) are almost rounded on the dorsal margin and have only a distal hook, bent ventrally. Saccus relatively short and slender, the phallus also short and generally smallest for the genus, as far as known, and with a dorsal hook. By combination of those structures genitalia can easily be differed from those of the second Australian species, *N. sulphurea* (Fig. 14), which has an uncus with two dorsal processes, a stronger process of the valves, an additional dorsal process of the labides, and generally is of larger size. All other taxa mentioned and/or described below differ also by those characters, details are mentioned there.

Female (Figs. 3–5). Forewing length (from wing basis to apex) 37–43 mm. Antennae with pectinations very narrow. Females occur in two colour morphs — a dark yellow form with more or less distinctive markings, and a reddish brown form (like the HT).

Fore- and hindwings as in ♂ but wings slightly more rounded, markings more distinct. Fore- and hindwing eyespots are much larger than in the ♂, and usually more heavily infused reddish brown; sometimes the hindwing eyespot is infused yellow.

Distribution. Known so far from several localities across the top end of the Northern Territory — from Bathurst and Melville Islands (collectively called the Tiwi Islands) (CDLA, CSNB & NTM), from northeast Arnhem Land (NTM), and from Groote Eylandt (ANIC). Specimens collected to date have all been from within or adjacent Monsoon Forest areas.

Notes. The habitat, biology requirements and distribution of *N. territorialis* n. sp. are very poorly understood at this stage. All adults have been collected within or nearly adjacent to Monsoon Forest areas. It is unusual amongst the *Neodiphthera* species to have collected a number of ♀♀, but only a single ♂. Our experiences with collecting *N. sulphurea* in northeastern Queensland, and *N. papuana* and *N. albicera* on the island of New Guinea, is that ♂♂ usually greatly outnumber ♀♀ collected at light — however, with *N. territorialis* n. sp. the reverse has been observed. The ♀♀ collected have also all been insular, suggesting that ♀♀ may be either nomadic or extremely sedentary in their movements. Further observation of the species will hopefully unravel the mysteries of its biology and habitat requirements.

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N. territorialis n. sp. is found sympatrically with *Attacus wardi* Rothschild, 1910, *Syntherata melvilla* (Westwood, 1853) and *Opodiphthera eucalypti* (Scott, 1864) on the Tiwi Islands, where all four species have recently been collected at light.

Due to the very bad condition of the single known ♂ of *N. territorialis* n. sp., we decided in this case to designate a ♀ holotype. Nevertheless, from comparision within barcode analysis it becomes clear that this singleton is conspecific with the known ♀♀, and that only one single species exists in the distributional area.

Neodiphthera campestris sp. n.

Holotype ♂ (Fig. 12): Indonesia, Irian Jaya (South), Timika env., x. 2005, leg. local collector, GP 2127/10 SNB, BC SNB 1814 (CSNB, will be deposited in ZMHU). A red holotype label witll be added accordingly.

Paratypes (in total 2 ♂♂): both Indonesia, Irian Jaya, Timika: 1 ♂, lowlands, ca. 4°30′ S, 136°44′ E, vi. 2002, leg. local people, via A. Schintlmeister, GP 2128/10 SNB, BC SNB 0468 (CSNB). 1 ♂, ii. 2003, leg. local collector, BC SNB 3860 [without result] (CSLL). Blue paratype labels will be added accordingly.

Etymology. campestris [Latin], inhabiting lowlands; named after the typical distributional pattern of the species, the lowlands along the southern coastline of West Papua.

Description.

Male (Fig. 12). Forewing length (from wing basis to apex) 41 mm (HT; PT in CSNB: 36 mm). Eyes black. Antennae 9–10 mm long, 25–26 segments, broadly quadripectinate except last 5–6 segments, longest rami 1.7 mm long. The only three known ♂ specimens are of more or less intensive yellow colour.

Head in ground colour, separated from the thorax by a grey collum which is darkened to the thoracal side. Thorax including legs and abdomen from dorsal and ventral side completely in ground colour. Forewing with relatively straight outer margin, apex almost rectangular, a little rounded. Hindwing margin almost round.

On dorsal side the forewing costa in the proximal half covered with grey scales, little darkened near to the basis. Forewing with reddish-grey hinted zigzag antemedian band, median area in ground colour, suffused with grey scales apically, and a round eyespot of around 4 mm diameter, circled outside greyish red, inner part yellow with central bluish grey dot; postmedian line almost straight, at its costal end with small curve to basal side, and followed in the postmedian area by a row of more or less indicated dots, ending apically with a field of black scales; postmedian area otherwise in ground colour.

Hindwing with same ornamentation, antemedian line rounded, ocellus of same manner as on forewing, postmedian line in zigzag form, also followed by a row of more or less indicated dots.

Underside of both fore- and hindwings similar to upperside, but of deeper yellow ground colour and with all markings in more intense manner, darker and broader. Both fore- and hindwing eyespots have a more or less indicated proximal inner bluish halfmoon, followed by a brown portion centrally.

Male genitalia (Figs. 17–18): *N. campestris* n. sp. has a short and broad-based uncus with two acute short dorsolateral tips. The valves have a relatively large, strongly scletorized, triangular distal tip, the labides typical with strong dorsal margin, with two processes, a slender dorsal one which is directed a little to dorsal side at its tip, and a distoventral one which is quite acute. Saccus long and slender. The phallus is large, broad and has a sclerotized hook on dorsal side which ends with two small dorsal tips. Generally the genitalia are relatively large for the genus. They differ from *N. sahulensis*, *N. territorialis* n. sp., described above, and *N. sophiae* n. sp., described below, mainly by the form and length of the uncus, the somewhat unusual dorsal tip of the labides, and the distally indented phallus, and generally are sclerotized more intensly than in the other species.

Female: Unknown.

Distribution. *N. campestris* n. sp. is known so far only from two localities around Timika, in the swampy lowlands south of Tembagapura and Carstensz Pyramide (Puncak Jaya), the highest peak of New Guinea. Judging from the locality, it may be expected to occur along the complete southern coastline of West Papua and even Papua New Guinea.

Notes. Although mentioned on the labels (and in the type label data cited above) to come from the Indonesian province of Irian Jaya, today the origin would have to be cited correctly as “West Papua” due to name changes in Indonesia; nevertheless, we decided to keep the existing labels with the old term which was correct at time of collecting.

Neodiphthera sophiae sp. n.

Holotype ♂ (Fig. 11): Indonesia, Moluccas, Kai Archipelago, Kai Besar I., Desa Pako, Gunung (Mt.) Dab, 250 m, 19. x. 2003, 1:52 h lt., leg. local people; genitalia slide no. 1473 U. Paukstadt; Genitalia-Preparation CBH-0401, Ulrich Brosch, Hille; bought 2004 from U. Paukstadt; BC SNB 1883 (CBH, will be deposited in ZMHU). A red holotype label will be added accordingly. – No paratypes.

Etymology. Named in honour of Sophia Nadine Squarra from Hille, one year-old granddaughter of Ulrich Brosch.

Description.

Male (Fig. 11). Forewing length (from wing basis to apex) 39.5 mm. Eyes black. Antennae 8.5 mm long, broadly quadripectinate except last 4–5 segments, widest parts of the antennae 3.9 mm (which is not equivalent with the sum of the length of longest left and right rami). The only specimen known to us is of more or less pale orange yellow colour.

Head in ground colour, separated from the thorax by a grey collum which is darkened to the thoracal side. Tho-

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Figs. 3–12: *Neodiphthera* specimens (a = dorsal, b = ventral side). — **Figs. 3–6:** *N. territorialis* n. sp., Australia, Northern Territory. **Figs. 3a, b:** ♀, HT, red morph, Gurrumuru, NTM. **Figs. 4a, b:** ♀, PT, dull yellow morph, Bathurst Island, CDLA. **Figs. 5a, b:** ♀, PT, yellow morph, Melville Island, CSNB. **Figs. 6a, b:** ♂, PT, Melville Island, CDLA. — **Figs. 7–9:** *N. sulphurea*, Australia, Queensland. **Figs. 7a, b:** ♂, yellow morph, Iron Range, CSNB. **Figs. 8a, b:** ♂, PT, pink morph, Iron Range, CSNB. **Figs. 9a, b:** ♀, PT, Iron Range, CDLA. — **Figs. 10a, b:** *N. sahulensis*, ♂, Indonesia, Aru Island, CSNB. — **Figs. 11a, b:** *N. sophiae* n. sp., ♂, HT, Indonesia, Kai Island, CBH > ZMHU. — **Figs. 12a, b:** *N. campestris* n. sp., ♂, HT, Indonesia, West Papua, Timika, CSNB > ZMHU. — Pictures of specimens approximately to the same scale (ca. 0.8 natural size), scale bars = 1 cm. — Photos: D.L. (Figs. 3, 4, 6, 9), S.N. (Figs. 5, 7, 8, 10, 12), U. Brosch (Fig. 11). — **Figs. 13–18:** ♂ genitalia of specimens of the genus *Neodiphthera*. **Fig. 13:** *N. territorialis* n. sp., PT, GP 2239/11 SNB. **Fig. 14:** *N. sulphurea*, PT, GP 518/01 SNB. **Fig. 15:** *N. sahulensis*, GP 2179/10 SNB. **Fig. 16:** *N. sophiae* n. sp., HT, GP CBH-0401 (incomplete genitalia, phallus and other details lacking). **Fig. 17:** *N. campestris* n. sp., HT, GP 2127/10 SNB. **Fig. 18:** *N. campestris* n. sp., PT, GP 2128/10 SNB. — Genitalia figures not to the same scale. Where available, scale bar = 1 mm.

rax including legs and abdomen from dorsal and ventral side completely in ground colour. Forewing with relatively straight outer margin, apex almost rectangular, a little rounded. Hindwing almost rounded, but little larger than in *N. campestris* n. sp. described above.

On dorsal side the forewing costa in the proximal half covered with grey scales, darkened near to the basis. Forewing with zigzag antemedian band of violet grey colour, median area in ground colour, widely suffused with grey scales in the costal area, and a round eyespot of around 4 mm diameter, circled outside greyish red, inner part yellow with central bluish grey dot and thin bluish white line on proximal side along the outer circle; postmedian line straight, only at its costal end with small curve to basal side, and followed in the postmedian area by a row of small dots; postmedian area otherwise in ground colour, marginal frindges little darker.

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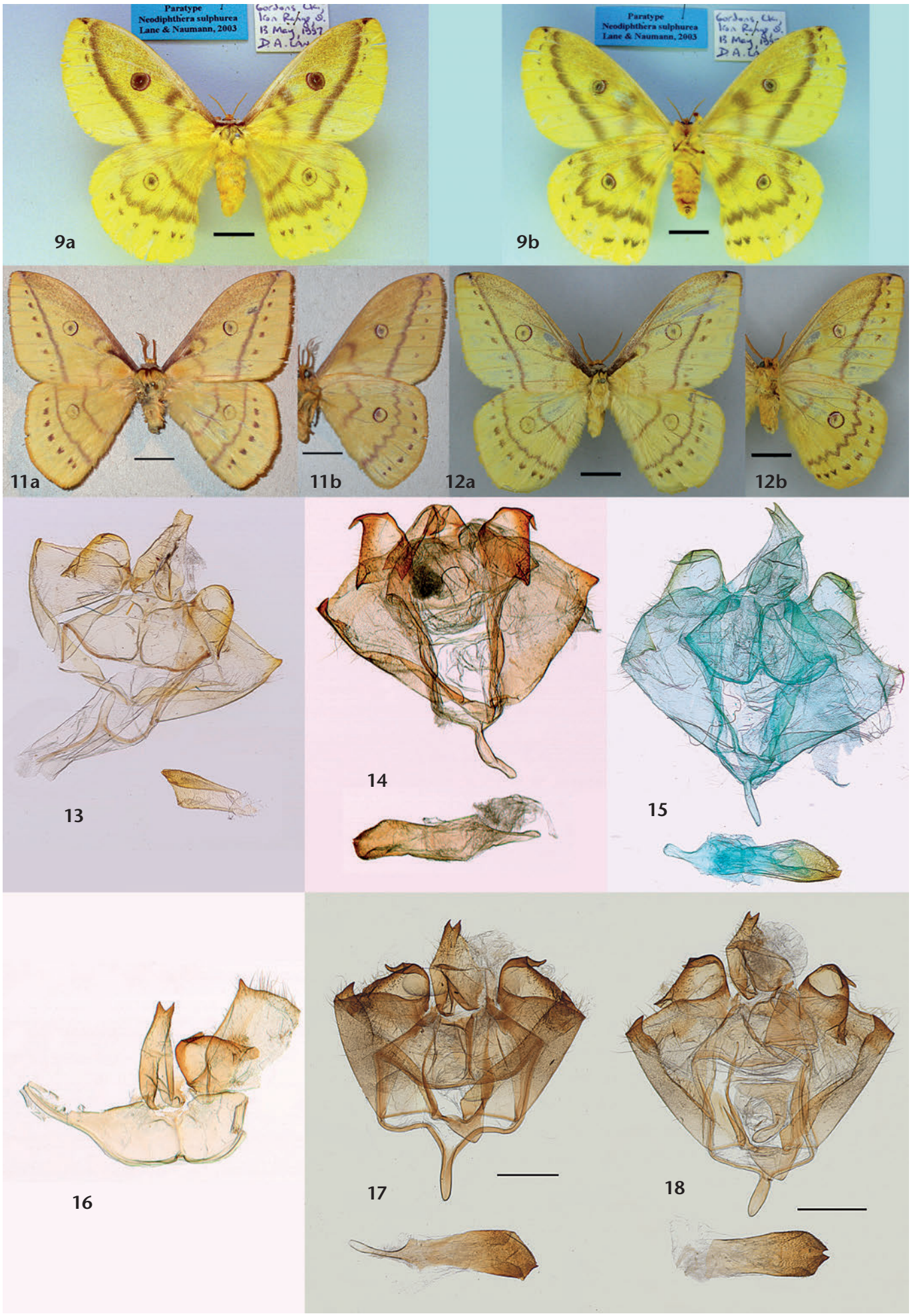

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Hindwing with same ornamentation, antemedian line rounded, ocellus of same manner as on forewing, postmedian line rounded, in the lower parts with zigzag ornamentation, also followed by a row of dots.

Underside of both fore- and hindwings similar to upperside, but of deeper dull yellow to orange ground colour and with all markings in more intense manner, darker and broader. Both fore- and hindwing eyespots have again the proximal inner bluish halfmoon, followed by a brown portion centrally. The hindwing postmedian line is strongly zigzag-formed, that of the forewing only a little in the apical part of the line.

Nothing can be said about variation of this species as we have only the holotype available for description.

Male genitalia (Fig. 16). Unfortunately the genitalia structures of the HT of *N. sophiae* n. sp. are somewhat destroyed; probably the specimen was pressed too much during preservation and transport. Nevertheless, important structures still can be seen from the preparation. The uncus is long, straight, and has two dorsolateral tips. The valve has one short distal tip, the labides show a very short, bent dorsal process, and a more rounded distoventral one. Saccus and phallus are lost.

Even from these rests of structures differences to the genitalia of *N. sahulensis* can be described as having less acute and shorter processes of the uncus and a much shorter dorsal process of the labides in *N. sophiae* n. sp., whereas the distal tip of the valves is more prominent.

Female: Unknown.

Distribution. *N. sophiae* n. sp. is only known from the Indonesian island of Kai, also known as Key or Kei Island. The Kai Archipelago, situated about 120 km west of the coastlines of the Aru Archipelago, is biogeographically somewhat isolated. During the last glacial periods never any land bridges between Kai on the one side and Aru Archipelago or the southern coast of New Guinea existed.

Notes. In other Saturniidae genera a similar separation between the two mentioned archipelagos can be found. While on Kai island the endemic *Attacus aurantiacus* Rothschild, 1895 can be found, this species is missing on Aru (Peigler 1989: 48), whereas here occurs another Attacini representative, *Coscinocera aruensis* Naumann & Löffler, 2010.

Discussion

The genus name *Neodiphthera* was first introduced by Bouvier (1936) for a group of species formerly listed in the genus *Opodiphthera* Wallengren, 1858, but due to some mistakes such as a missing designation of a type species his description is not available. Fletcher (1982) was the first to note this, and redescribed this genus, citing *O. papuana* Rothschild, 1904 as typus generis. Lane & Naumann (2003) gave an overview of the then existing literature, including the citation of Australian records in, e.g., Common (1990) and Edwards (1996). The handling by D'Abrera (1998) as "*Opodiphthera* Wallengren, 1858 = *Neodiphthera* auctt." was considered as being no formal synonymisation of the two genera; this author figured *N. papuana* and *N. albicera* nicely and showed the differences of both taxa. Since then the genus was handled in different manner, partly as a subgenus of *Opodiphthera* (e.g., Paukstadt & Paukstadt 2003, Paukstadt et al. 2003), but nowadays it is accepted again on generic rank (overview in Paukstadt & Paukstadt 2012a, b).

The five taxa dealt with in this paper all occur in the lowlands around the Arafura Sea. *N. sulphurea* from Queensland is the most disctinctive taxon in this group, with known male colour morphs in yellow and pink with few and strong ornamentation (Figs. 7, 8). The two known ♀♀ (ANIC, CDLA) are of yellow colour (Fig. 9). *N. sulphurea* is relatively large and has a quite broad and rounded wing shape, compared to the other involved taxa.

The second Australian species, *N. territorialis* n. sp. (Figs. 3–6), described above, has in the ♂ much narrower fore- and hindwings, an more acute forewing apex, and a distinctive fore- and hindwing ocellus. So far only a single yellow ♂ is known which is coloured more vivid than those of *N. sulphurea*. On the ventral side *N. territorialis* n. sp. is much more intensively marked than the other three species of this group. Both fore- and hindwing eyespots of *N. territorialis* n. sp. are very distinctive. The reddish brown colouration of the fore- and hindwing line markings of the ♂ *N. territorialis* n. sp. is also in contrast to the brown line markings of *N. sulphurea*, and is more strongly pronounced than the lighter wing markings of *N. sahulensis, N. sophiae* n. sp. and *N. campestris* n. sp.

The three Indonesian species dealt with here are much more similar to each other than the two Australian ones; while *N. sahulensis* ♂♂ have somewhat prolate hindwings with relatively narrow-approached ante- and postmedian lines, especially on the hindwings, the hindwings of *N. sophiae* n. sp. are somewhat more rounded and have more separated lines, and those of *N. campestris* n. sp. are most rounded and lines are most widely separated. The inner portion of the wing ocelli of *N. sahulensis* is almost lentiform while in the two new described taxa this center part is more or less round.

The ♀ of *N. territorialis* n. sp. is also readily separated from that of *N. sulphurea* (Fig. 9) by its relatively longer and narrower fore- and hindwing shape, by the much straighter forewing termen, and by the much straighter and narrower central forewing band.

Generally, there are only minor differences to be found in ♂ genitalia structures in the entire genus *Neodiphthera*, but also within the members of other Indo-Australian genera such as *Opodiphthera* and *Syntherata* Maassen, 1873 (compare also Lane & Naumann 2003: 85). Nevertheless, there are small but stabile differences in these structures between the here handled species as far as can be seen from the small amount of material currently available to us, and also if compared to other taxa

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within the three above mentioned genera. Morphological differences are sustained by the results of the mtDNA barcoding of the involved taxa.

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